Geostationary Operational Environmental Satellite (GOES)

GOES-R Series

Advanced Baseline Imager (ABI)

Unique Instrument Interface Document (UIID)

Draft Implementation

January 23, 2004

National Aeronautics and Space Administration

Goddard Space Flight Center
Greenbelt, Maryland

To verify the correct version of this document, please contact the GOES R Series Requirements Management Office on 301-286-7898

Table of Contents

1 Scope

ABIUIID2 *GIRD3* *GIRD7* The purpose of this Unique Instrument Interface Document (UIID) is two-fold. The first is to allocate GOES-R series spacecraft resources to the Advanced Baseline Imager (ABI). The second is to serve as a core building block on which the ABI-spacecraft interface can be designed. The spacecraft integrating contractor and the ABI contractor **shall** meet each of their respective interface requirements as defined in this document.

The Government will be the system integrator until a system performance contractor or spacecraft contractor with that responsibility is selected. Until that time, the Government will be responsible for accommodation trades, resource allocation (weight, power, space, bandwidth, etc.), and resolving interface issues. This UIID will govern the development of an Interface Control Document (ICD) which will be a joint activity of the ABI and spacecraft contractors.

The ABI ICD establishes the details of the electrical, communications, mechanical, thermal, integration and test, and command and data handling (C&DH) interfaces between the ABI instrument and the GOES-R spacecraft. After the ICD is signed and approved by all parties, the spacecraft contractor **shall** maintain the ICD.

The Advanced Baseline Imager (ABI) is a multispectral, two-axis scanning radiometer designed to provide variable area imagery and radiometric information of the Earth's surface, atmosphere and cloud cover. The instruments collect data on a three-axis body-stabilized satellite in geosynchronous orbit. Capability for star sensing by the instrument is required. ABI is designed to measure solar reflected radiance simultaneously in all spectral channels.

Data availability, radiometric quality, simultaneous data collection, coverage rates, scan flexibility, and minimizing data loss due to the sun are prime requirements of the system. The instrument requires primary power and command input data from the spacecraft. Instrument output data to the spacecraft contains instrument information, instrument telemetry and ancillary data.

The sensor modules contain the optical system, scanner, detectors and their cooling systems and directly related electronics. The electronics module contains the power supply module, command, control, and data processing circuitry. If required, an auxiliary electronics module may be used for active detector cooling.

1.1 Document Overview

Together, the General Interface Requirements Document (GIRD) and the ABI UIID establish the ABI-spacecraft interface requirements. The GIRD applies to all GOES-R instruments while the ABI UIID is specific to the ABI. Section 1 explains the use of this document. Section 2 lists reference documents. Section 3 allocates spacecraft resources, such as mass, power, and data rate, to the ABI instrument. Section 4 contains government-accepted operation constraints. Section 5 contains government-accepted deviations from the GIRD. Section 6 contains a list of acronyms used within this document.

1.2 Missing Requirements

The term "(TBD)", which means "to be determined", applied to a missing requirement

means that the instrument contractor determines the missing requirement in coordination with the spacecraft contractor.

The term "(TBR)", which means "to be refined/reviewed", means that the requirement is subject to review for appropriateness by both contractors, and subject to revision. The instrument contractor is liable for compliance with the requirement as if the "TBR" notation did not exist. The "TBR" merely provides an indication that the value is more likely to change in a future modification than requirements not accompanied by a "TBR".

1.3 Definitions

The requirements stated in this document are not of equal importance or weight.

- "**Shall**" designates the highest weighting; that is, mandatory. Any deviations from these contractually imposed mandatory requirements require the approval of the NASA contracting officer.

- "Will" designates a lower weighting level. The will requirements indicate the intent of the Government or spacecraft contractor and are often stated as examples of acceptable designs, items and practices. Unless required by other contract provisions, noncompliance with the will requirements does not require approval of the NASA contracting officer and does not require documented technical substantiation.

2 Applicable Documents

The following documents are referenced in this specification.

Document Number	Title
GSFC 417-R-ABIPORD-0017	GOES Advanced Baseline Imager (ABI) Performance and Operational Requirements Document (PORD)
GSFC 417-R-GIRD-0009	General Interface Requirements Document (GIRD)

3 Allocations

The GOES-R provides communications, power and a platform for the ABI instrument. The following paragraphs allocate these resources to ABI.

3.1 Command and Data Handling

3.1.1 Instrument-to-Spacecraft Science Volume

ABIUIID15 *GIRD443* The instrument science and engineering data rate, including all overhead associated with CCSDS packitization by the instrument, **shall** not exceed 66.6 million (10^6) bits per second when averaged over any 5 second period.

3.1.2 Telemetry Data Rate

ABIUIID17 Housekeeping telemetry data rate, including all overhead associated with CCSDS packitization by the instrument, at the spacecraft interface **shall** not exceed 1024 bits per second.

3.1.3 Application Process Identifiers

The ABI **shall** use no more than 255 consecutive APIDs for science, telemetry, and command packets.

3.2 Power

3.2.1 Average Power

ABIUIID20 The ABI **shall** draw no more than 450 watts averaged over 5 minutes.
GIRD272
GIRD273

3.2.2 Peak Power

ABIUIID22 The ABI **shall** draw no more than 562 watts peak power.
GIRD272
GIRD273

3.2.3 Survival Power

ABIUIID24 The ABI **shall** require no more than 100 watts to maintain survival temperatures.
GIRD385
GIRD386

3.3 Mechanical

The requirements in this section apply to the structural and mechanical components of the instrument flight units (sensor unit, electronics unit and, if applicable, auxiliary electronics unit).

3.3.1 Mass Properties

ABIUIID28 The ABI, including all units and cabling between units, **shall** have mass less than 275 kilograms.
GIRD79
GIRD81

3.3.2 Cabling Between Units

ABIUIID80 The maximum length of the harness cables between ABI units **shall** be as specified in the following table:

Item	Module Cable Connections	Max Length (m)
1	Electronics to sensor	4
2	Auxiliary electronics to sensor	4
3	Auxiliary electronics to electronics	2.5

Cables between ABI units will be the responsibility of the ABI contractor.

3.3.3 Volume

ABIUIID30 *GIRD59* *GIRD1056* The ABI, including mounts, thermal blankets and connectors for both stowed and operational configurations, **shall** have dimensions that do not exceed the limits listed in the Instrument Module Envelopes Table.

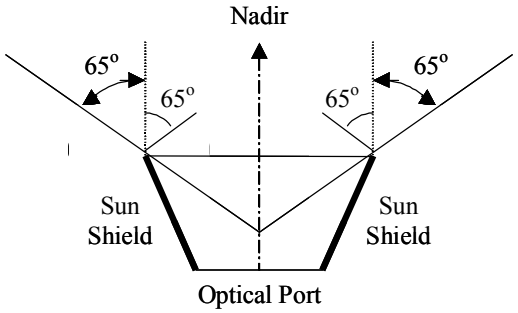
Instrument Module Envelopes Table

Component	Width (cm) (X)	Height (cm) (Y)	Depth (cm) (Z)
Sensor unit*	175.0	120.0	150.0
Primary Electronics	40.0	40.0	65.0
Auxiliary Electronics	25.0	20.0	50.0

* For the sensor unit only, width is east-west, height is north-south, and depth is nadir-zenith

3.3.4 Optical Port Field-of-View

ABIUIID32 *GIRD73* The spacecraft **shall** provide the sensor unit's optical port a clear field-of-view within 65° of nadir as shown in the following figure.



3.3.5 Radiator Field-of-View

ABIUIID34 *GIRD73* The spacecraft **shall** provide the sensor unit's -Y face a 2π steradian clear field-of-view to space. The -Y axis is in the Body Reference Frame (BRF) defined in the GIRD.

3.3.6 Mounting

ABIUIID36 *GIRD100* The spacecraft **shall** provide the instrument sensor unit a nadir-facing mounting surface.

ABIUIID83 *GIRD100* The spacecraft mounting surface **shall** have as a minimum the same dimensions of the sensor unit envelope anti-nadir plane.

ABIUIID84 *GIRD100* The sensor unit mechanical interface **shall** lie within the anti-nadir plane of the sensor unit envelope.

ABIUIID85 GIRD100 The instrument sensor unit **shall** use kinematic mounts for its mechanical interface to the spacecraft.

3.4 Instrument-to-Spacecraft Disturbances

These requirements apply while the instrument is in orbit and operating.

3.4.1 Pointing Error

ABIUIID40 *GIRD165* For each orthogonal axis on the spacecraft side of the sensor unit interface, the operation of the sensor unit **shall** contribute less than 100 microradians to total spacecraft attitude pointing error.

3.4.2 Angular Rate Error

ABIUIID42 *GIRD165* For each orthogonal axis on the spacecraft side of the sensor unit interface, the operation of the sensor unit **shall** contribute less than 40 microradians per second in magnitude to the total spacecraft pointing error rate when the total rate is filtered by at least a fourth order low pass Butterworth filter with a -3dB response at 15 Hz.

3.4.3 Instrument Translation Acceleration Limits

ABIUIID44 *GIRD165* For each orthogonal axis on the spacecraft side of each sensor unit interface, the operation of the sensor unit **shall** contribute less than the magnitude limits specified in Instrument-to-Spacecraft Linear Acceleration Limits to the total translational acceleration when the total acceleration is filtered by at least an eighth order band pass Butterworth filter with a -3dB response at f_1 and f_2.

Instrument-to-Spacecraft Linear Acceleration Limits

f_1 (Hz)	f_2 (Hz)	Peak Limit (mg)	f_1 (Hz)	f_2 (Hz)	Peak Limit (mg)	f_1 (Hz)	f_2 (Hz)	Peak Limit (mg)
0.0	512.0	1.80	26.9	30.2	0.05	114.0	128.0	0.17
0.9	10.1	0.18	28.5	32.0	0.05	120.8	135.6	0.17
6.3	32.0	0.12	30.2	33.9	0.17	128.0	143.7	0.17
20.2	101.6	0.36	32.0	35.9	0.17	135.6	152.2	0.17
64.0	322.5	0.84	33.9	38.1	0.17	143.7	161.3	0.17
203.2	512.0	1.68	35.9	40.3	0.17	152.2	170.9	0.17
9.0	10.1	0.05	38.1	42.7	0.17	161.3	181.0	0.17
9.5	10.7	0.05	40.3	45.3	0.17	170.9	191.8	0.17
10.1	11.3	0.05	42.7	47.9	0.17	181.0	203.2	0.17
10.7	12.0	0.05	45.3	50.8	0.17	191.8	215.3	0.17
11.3	12.7	0.05	47.9	53.8	0.17	203.2	228.1	0.17
12.0	13.5	0.05	50.8	57.0	0.17	215.3	241.6	0.17
12.7	14.3	0.05	53.8	60.4	0.17	228.1	256.0	0.17
13.5	15.1	0.05	57.0	64.0	0.17	241.6	271.2	0.17
14.3	16.0	0.05	60.4	67.8	0.17	256.0	287.4	0.17
15.1	17.0	0.05	64.0	71.8	0.17	271.2	304.4	0.17
16.0	18.0	0.05	67.8	76.1	0.17	287.4	322.5	0.17
17.0	19.0	0.05	71.8	80.6	0.17	304.4	341.7	0.17
18.0	20.2	0.05	76.1	85.4	0.17	322.5	362.0	0.17
19.0	21.4	0.05	80.6	90.5	0.17	341.7	383.6	0.17
20.2	22.6	0.05	85.4	95.9	0.17	362.0	406.4	0.17
21.4	24.0	0.05	90.5	101.6	0.17	383.6	430.5	0.17
22.6	25.4	0.05	95.9	107.6	0.17	406.4	456.1	0.17
24.0	26.9	0.05	101.6	114.0	0.17	430.5	483.3	0.17
25.4	28.5	0.05	107.6	120.8	0.17	456.1	512.0	0.17

3.4.4 Predicted Interface Force and Torque (PIFT) Responses

ABIUIID71 The ABI **shall** send predicted forces, torques and future times to the spacecraft in a CCSDS source packet per the Command and Data Handling section of the GIRD.

ABIUIID66 The ABI **shall** send to the spacecraft predicted forces and torques resulting from normal instrument operations.

ABIUIID68 The ABI **shall** send to the spacecraft predicted forces and torques computed in the instrument coordinate system.

ABIUIID69 The ABI **shall** send to the spacecraft forces and torques predicted from a uniformly spaced series of future times.

ABIUIID70 The ABI **shall** increment the future time values for predicted forces and torques sent to the spacecraft by 50 ms (TBR) or less.

ABIUIID72 The ABI **shall** send to the spacecraft predicted forces and torques at least 250 ms (TBR) prior to the predicted time.

ABIUIID73 The ABI **shall** send to the spacecraft predicted forces and torques with the future time data using the P-field format in GIRD453.

ABIUIID74 The ABI **shall** send to the spacecraft predicted force data with a least significant bit of 0.001 N (TBR).

ABIUIID75 The ABI **shall** send to the spacecraft predicted torque data with a least significant bit of 0.001 N-m (TBR).

ABIUIID76 The ABI **shall** send to the spacecraft predicted force data with an accuracy of +/- 0.03 N (TBR).

ABIUIID77 The ABI **shall** send to the spacecraft predicted torque data with an accuracy of +/- 0.03 N-m (TBR).

3.5 Thermal

ABIUIID91 *GIRD189* The instrument electronics module and auxiliary electronics module total heat transfer to the spacecraft **shall** not exceed 200 Watts.

4 Constraints

In order to ensure proper instrument performance or to prevent possible instrument damage, the following Government-approved constraints are imposed by the instrument developer on spacecraft integration and test activities, including launch, activation and operations.
No constraints have been identified at this time.

5 Deviations/Waivers

This section identifies GIRD requirements that the government has relaxed or waived for this instrument. Where appropriate, corresponding GIRD paragraph titles and numbers are identified in parentheses.
There are no deviations or waivers at this time.

6 Acronyms

ABI	Advanced Baseline Imager
APID	Application Process Identifier
C&DH	Command and Data Handling
CCR	Configuration Change Request
GIRD	General Interface Requirements Document
GOES	Geostationary Operational Environmental Satellite
GSFC	Goddard Space Flight Center
Hz	Hertz
ICD	Interface Control Document
kg	kilogram
m	meter
Mbps	million bits per second
mg	milli-g's (where g is gravitational acceleration at Earth surface)
NASA	National Aeronautics and Space Administration
PORD	Performance and Operational Requirements Document
TBD	to be determined
TBR	to be resolved
TBS	to be specified
UIID	Unique Instrument Interface Document